

Mass Control of Dental Caries Through the Use of Domestic Water Supplies Containing Fluorine

FREDERICK S. McKAY, D.D.S.
Colorado Springs, Colo.

BASED upon the generally prevailing rate of decay and tooth loss the forecast for the future is grim to the point of seriousness. A prediction published by an authoritative source as recently as June, 1947,¹ puts it as follows:

"It is estimated that . . . the 3,400,000 children born in 1946 . . . at 16 years of age will (each) require 7 fillings and 2 extractions and that 40 per cent of those reaching 40 years of age will require dentures."

Evidence collected during the past several years has established that the

continuous use of a domestic water supply containing even as low as approximately 1 p.p.m. of fluoride, during the period of tooth calcification, will bring about a mass reduction in the dental decay rate. As will be apparent later in this paper the conditions existing in fluorinated districts are in complete disrelation with the prediction quoted just above.

The evidence up to the present time has been derived almost wholly from examinations of children. There has been almost no information as to the dental

TABLE 1

Summary of observations on 400 Colorado Springs (Colo.) natives having dental fluorosis

Age Groups	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45 and above
Number of persons examined	65	89	70	66	35	26	26	23
Number of persons showing no dental caries experience	42	44	23	14	8	4	1	4
Number of teeth showing untreated dental caries or fillings	71	135	166	259	136	97	192	136
Number of teeth lost because of dental caries *	4	5	6
Number of teeth lost (all causes)	4	5	10	12	19	12	16	22
Number of decayed or filled teeth per person	1.09	1.51	2.37	3.91	3.88	3.73	7.38	5.91

* In the higher age groups it is not possible to determine accurately whether teeth were lost by caries or by other causes.

Total number of persons	400	Average decayed and filled teeth per person	2.98
Number of persons showing no decay experience	140	Total number of teeth lost (all causes)	100
Per cent of persons showing no decay experience	35	Total number of incisor and cuspid teeth showing decay experience	45
Total number of teeth showing decay experience	1,192		

Comparison of Tooth Loss at Colorado Springs with "Standardized Rate"

"Standardized Rate" * tooth loss per person	..	1.2	2.3	3.8	5.8	7.9	10.2	..
Tooth loss (all causes) per person, Colorado Spgs.	0.06	0.05	0.14	0.18	0.54	0.46	0.61	0.95

* From, Klein, H. *J.A.D.A.* 30:80-96 (Jan.), 1943 (table 4); data represent 45,500 white U. S. Adults, all socio-economic groups.

condition of adults who had acquired fluorosis of the teeth during childhood.

The data in the tables which follow were collected in the City of Colorado Springs, Colo., during the past three years, and are intended in part to supply this important information.

The observations summarized in Table 1 are not from a selected group of people but were made from persons as they presented themselves from day to day. All are natives of continuous residence with continuous use of the city water supply which has fairly consistently maintained a level of 2.6 p.p.m. of fluoride, since the first determinations were made several years ago.

The purpose of this paper is to show the actual condition that exists in this community after about 70 years of use of this water supply.

This is set forth in Table 1.

In addition to showing the average decay experience rate (untreated and filled teeth) in the different age groups, the table shows that this rate for the entire group is 2.98 per person. It will be noted also that slightly more than one-third (35 per cent) of these persons had experienced no decay whatever. The average age of the group is about 25 years. The age groups 10-14 and 15-19 show the remarkably low decay experience rates of 1.09 and 1.51 respectively, the decayed areas being practically limited to the fissures and pits in the molar teeth. The low incidence of caries experience in fluorosed upper anterior teeth cited by Dean² is confirmed by the present study, in which it was found that of the 1,192 teeth showing caries experience only 45 were in the incisor and cuspid group.

From the above it is apparent that decay of the proximal surfaces of fluorosed incisors and cuspids is almost negligible. The "standardized rate" of tooth loss as it appears in Table 1, has been accepted as a measure of the prevailing tooth loss from all causes. Table

1 shows a slowly increasing average decay experience rate as the ages advance, for which no explanation is suggested, but it is important to note that at the highest average rate shown (the 40-44 year group) the rate is considerably less than the *tooth loss* rate in the "standardized rate" table. The significance of these rates of decay experience and tooth loss can be best comprehended by comparison with a non-fluoride community such as the City of Madison, Wis. * This comparison is shown in Table 2 which was compiled by Dr. John G. Frisch of Madison.

The observations summarized in Table 3 were made in Colorado Springs and Montrose, Colo.,³ the persons examined having acquired fluorosis of the teeth in other widely scattered communities and districts through the use of domestic waters containing fluoride. These districts were generally in the middle and southwestern states and in other parts of Colorado.

Tables 1 and 3 bear a close similarity. Perhaps the most important comment pertaining to Table 3 is that the inhibitory effect of fluorine, once acquired, is permanent and is not diminished by later migrations. It is not necessary that the use of fluorinated water be continued. It is indicated also that the average rates of decay experience and tooth loss shown in Colorado Springs are by no means peculiar to that city alone. Examinations made in other communities using fluorinated water supplies, in various parts of the country, have shown that the average decay rate remains consistently at about 3 and that about one-third of the native persons are caries-free.⁴

It seems, therefore, that a pattern has been established which indicates what may be expected in any community that uses a fluorinated water supply. Bearing

* Madison is one of the cities that have recently undertaken a project for fluorination of its water supply.

TABLE 2

Comparative LOSS OF TEETH AND DENTAL DECAY EXPERIENCE by Age Groups

MADISON
0.05 FLUORINE P.P.M.

COLORADO SPRINGS
2.6 FLUORINE P.P.M.

		NUMBER EXAMINED	NUMBER NO DECAY	NUMBER WITH AND FILLED TEETH	DECAYED TEETH	EXTRACTED TEETH	PERCENT NO DECAY AND FILLED TEETH	AVERAGE NO. EXTRACTED TEETH PER PERSON
AGES 10-14	MADISON	840	33	5538	376	7.04	0.448	
	COLORADO SPRINGS	60	40	66	4	1.10	0.067	
6 TIMES AS MUCH DECAY EXPERIENCED PER PERSON 7 TIMES AS MANY EXTRACTED TEETH PER PERSON								
AGES 15-19	MADISON	224	4	2446	323	12.36	1.442	
	COLORADO SPRINGS	167	78	277	11	1.72	0.065	
7 TIMES AS MUCH DECAY EXPERIENCED PER PERSON 22 TIMES AS MANY EXTRACTED TEETH PER PERSON								
AGES 20-24	MADISON	158	0	2182	509	17.03	3.222	
	COLORADO SPRINGS	101	33	254	9	2.60	0.089	
7 TIMES AS MUCH DECAY EXPERIENCED PER PERSON 36 TIMES AS MANY EXTRACTED TEETH PER PERSON								
AGES 25-29	MADISON	106	0	1336	569	17.97	5.367	
	COLORADO SPRINGS	93	18	331	23	3.80	0.246	
5 TIMES AS MUCH DECAY EXPERIENCED PER PERSON 22 TIMES AS MANY EXTRACTED TEETH PER PERSON								
AGES 30-34	MADISON	82	0	1174	477	20.13	5.817	
	COLORADO SPRINGS	46	10	159	18	3.84	0.391	
5 TIMES AS MUCH DECAY EXPERIENCED PER PERSON 15 TIMES AS MANY EXTRACTED TEETH PER PERSON								
AGES 35-39	MADISON	85	0	1135	577	20.14	6.788	
	COLORADO SPRINGS	37	6	119	11	3.51	0.298	
6 TIMES AS MUCH DECAY EXPERIENCED PER PERSON 23 TIMES AS MANY EXTRACTED TEETH PER PERSON								
AGES 40 and ABOVE	MADISON	251	0	2310	2976	21.06	11.857	
	COLORADO SPRINGS	64	6	379	24	6.29	0.375	
3 TIMES AS MUCH DECAY EXPERIENCED PER PERSON 32 TIMES AS MANY EXTRACTED TEETH PER PERSON								

* All causes

JOHN G. FRISCH, D.D.S.
MADISON, WIS.

FREDERICK S. MCKAY, D.D.S.
COLORADO SPRINGS, COLO.

July, 1947

Table 2 was computed from charts compiled prior to those used as Tables 1 and 3 in this paper which accounts for the slight variations.

TABLE 3

(Observed in Colorado Springs and Montrose, Colo.)

Summary of observations on 218 migratory persons having dental fluorosis

Age Groups	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45 and above
Number of persons examined	51	80	32	20	13	8	7	7
Number of persons showing no dental caries experience	25	35	8	5	3	1	0	1
Number of teeth showing dental caries or fillings	76	155	93	66	43	28	36	33
Number of teeth lost because of dental caries *	8	7	3	1	0
Number of teeth lost (all causes)	8	7	3	8	0	4	4	4
Number of decayed or filled teeth per person	1.49	1.93	2.90	3.30	3.30	3.50	5.14	4.71

* In the older groups it is not possible to determine accurately whether teeth were lost by caries or by other causes.

Total number of persons	218	Average decayed and filled teeth per person	2.43
Number of persons showing no decay experience	78	Total number of teeth lost (all causes)	38
Per cent of persons showing no decay experience	35.7	Total number of incisor and cuspid teeth showing decay experience	16
Total number of teeth showing decay experience	530		

Comparison of Tooth Loss in this Migratory Group with "Standardized Rate"

"Standardized Rate" * tooth loss per person	..	1.2	2.3	3.8	5.8	7.9	10.2	..
Tooth loss (all causes) per person in this migratory group	0.15	0.08	0.09	0.40	0.0	0.5	0.5	0.5

* From, Klein, H. *J.A.D.A.* 30:80-96 (Jan.), 1943 (table 4); data represent 45,500 white U. S. Adults, all socio-economic groups.

on the relation between the degree of fluorosis of the teeth and the caries experience rate, a significant observation made on the Colorado Springs group was that in 137 of the first 300 persons examined the degree of fluorosis was classified as "mild." Their average caries experience rate was 2.46 and 55 (40 per cent) of this group were caries-free.

It has not been maintained that any benefit will accrue to teeth formed prior to the use of fluorinated water, and yet it cannot be said that this will not be the case. Reliable evidence bearing upon this point would be difficult to obtain, but there is a feeling that such teeth may experience some benefit.

Primarily this is a long-range influence directed toward the reduction of tooth decay in children and at the same time endowing the teeth with a resistance against decay that extends, as the tables show, well into adult life.

The chief research project in dentistry has been and still is to determine the

cause of decay and to devise means for its elimination. No caries reduction program encountered thus far has succeeded in delivering any considerable segment of a mass population into adult life with an average caries experience rate of about 3 and a complete absence of decay in approximately one-third of a native population, as has the use of a domestic water supply in which fluorine is a natural constituent. Some twenty-five communities in this country have accepted the evidence as sufficiently conclusive to warrant the addition of fluoride in a proper proportion to their domestic water supplies as a means of reducing the decay rate. If in the future some method of further reducing the decay rate should be available, it need not necessarily be in conflict with the action exerted by fluorine.

REFERENCES

1. Editorial, *J. Am. Dent. A.* 34, 12:831 (June 15), 1947.
2. Dean, H. T. *Epidemiological Studies in the*

United States. Amer. Assoc. Adv. Science II. *Dental Caries and Fluorine*, 1946.

Dean, H. T., et al. *Pub. Health Rep.*, 54, 21:862-888 (May 26), 1939.

Dean, H. T., et al. Domestic Water and Dental Caries. *V. Pub. Health Rep.* 57, 32:1155-1179 (Aug. 7), 1942.

Dean, H. T., et al. *Pub. Health Rep.* 56, 15:761-792 (Apr. 11), 1941.

3. Downs, R. A., and McKay, Frederick S. A Reverse Approach to the Fluorine-Dental Caries Hypothesis. *A.J.P.H.*, 36, 11:1307-1308 (Nov.), 1946.

4. Dean, H. T. Fluorine and Dental Caries. *Am. J. Orth. & Oral Surg.*, 33, 2:49-67 (Feb.), 1947.

Dean, H. T. Fluorine, Mottled Enamel and Dental Caries. *J. Pediat.*, 16, 6:782-794 (June), 1940.

Dean, H. T. Domestic Water and Dental Caries.

V. Pub. Health Rep., 57, 32:1155-1179 (Aug. 7), 1942.

Dean, H. T. Domestic Water and Dental Caries, II. *Pub. Health Rep.*, 56, 15:761-792 (Apr. 11), 1941.

Hoffman, O. E. Examinations in Certain Counties in Iowa, 1947. Unpublished.

Frisch, J. G., et al. Summary of Comparative Dental Survey Union Grove—Madison, Wis. Private Correspondence, 1946.

Downs, R. A., McKay, Frederick S., and Frisch, J. G. Survey of Public School Children in Salida, Colo., 1947. Unpublished.

NOTE: Grateful acknowledgement is made to Mark F. Bryant, D.D.S., of Colorado Springs for his assistance in collecting data.

Sixth Annual Meeting United States-Mexico Border Public Health Association

The Sixth Annual Meeting of the United States-Mexico Border Public Health Association was held in Laredo, Tex., and Nuevo Laredo, Mexico, March 20-22. Nearly 300 persons were in attendance with almost as many from the South of the Border as from the North.

Sessions were held on international coöperation in health, on Border sanitation, on tuberculosis and its control, with special reference to BCG, on meningitis and other communicable diseases, and on the problems confronting the mother and child. Excellent exhibits were shown from the Section on Public Health Education of the Ministry of Health and Welfare of Mexico. Coöperating agencies beside the Ministry of Health were the U. S. Public Health Service, the Ministry of Hydraulics in Mexico, the Ministry of Agriculture in Mexico, the Institute of

Inter-American Affairs, the U. S. Children's Bureau, the International Boundary and Water Commission, the Rockefeller Foundation, the University of Vera Cruz, the Texas Tuberculosis Association, the Crippled Children's Foundation, and the Pan American Sanitary Bureau.

It was decided to hold the meeting in 1949 at Nogales, Ariz., and Nogales Sonora, Mexico.

The new officers for the Border Public Health Association were elected as follows.

President: Dr. Victor Ocampo Alonzo, Hermosillo, Sonora

President-Elect: Dr. George W. Cox, Austin, Tex.

Vice-Presidents: Dr. Jose Angulo Araico, Mexicali, Baja, Calif.; Dr. J. P. Ward, Phoenix, Ariz.

Secretary: Dr. M. F. Haralson, El Paso, Tex.

Pro-Secretary: Dr. Gustavo A. Roviroso, El Paso, Tex.